

Mechelectric



VOL. 11

DECEMBER 1951

NO. 3



THE SCHOOL OF ENGINEERING
GEORGE WASHINGTON UNIVERSITY

Another page for

YOUR BEARING NOTEBOOK



How to help a plug keep plugging

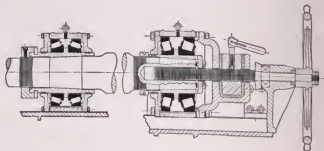
Pulp for paper making is chewed up inside this Jordan engine by a cone-shaped plug that forces the pulp against knife edges in the shell. Clearance between plug and shell must be held extremely close, so the designers mounted the plug shaft on Timken® bearings. Timken bearings take radial and thrust loads in any combination, keep shafts in positive alignment. Deflection and end movement are eliminated.

Mounting plug shaft bearings

The application shown here uses four single-row Timken tapered roller bearings mounted in pairs for the thrust and floating ends of the plug shaft. They are mounted directly on tapered sleeves and adjusted by means of shims between the cup follower and bearing housing.

The right hand or thrust end bearing assembly carries the thrust load and is clamped on the shaft by means of an end cap and cap screws. A nut next to the tapered sleeve facilitates removal of the bearing assembly.

Both thrust and floating ends are free to move laterally as the plug and shell are adjusted for clearance. Closures are of the piston-ring type.



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TAPERED ROLLER BEARINGS

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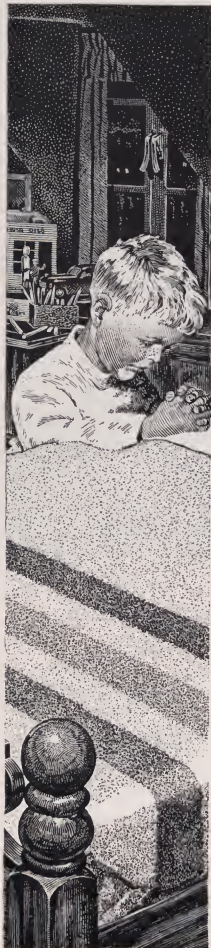
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BOEING



Jimmy said *two billion prayers*

"God bless everybody!" he said...short and sweet.

"Then I kissed him goodnight, tucked him in, put out the light and went downstairs.

"That was a *big* order! Two billion people on this earth... and Jimmy was praying for them all!

"Now... if *you* were going to have that many people blessed, what *one* big blessing would you wish for them all?

"Freedom! What finer thing than Freedom for all the peoples of the world? Why, anybody who knows what our Freedom really means would give his eyeteeth to be an American citizen. Let's see why:

"Here we have freedom of religion. Our newspapers can say anything they want and so can we, short of libel, slander or sedition. Our kids are taught Freedom from kindergarten up. Here we have a free choice of places to live in, businesses to go into or jobs to work at, like mine at Republic (you ought to see the steel we're producing down at the plant!)"

"Come voting time, nobody sees us mark our ballots... nor can he know *whom* we vote for. And we can squawk our heads off in town meetings or write what we think to our Congressmen... and nobody puts us in jail for it.

"As long as we don't step on the other fellow's Freedom, we Americans are the freest people in the world. But there are plenty of people trying to rob us of those Freedoms and run things *their* way. *Outside* enemies... but we have plenty *inside*, too. They sneak into our schools, businesses, unions, social clubs... *everywhere!*

"Let's keep an eye on those who attack our Freedoms... while Jimmy prays for the other two billion whose greatest blessing would be the Freedoms we already *have!*"

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Frontispiece: Interior view of the air return passage in the 16-foot transonic wind tunnel at Langley Aeronautical Laboratory. This view of the giant steel tube shows the straight passage, 400 feet long and 58 feet in diameter at the far end.

—Photo courtesy NACA

ENGINEERING SCHOOL CALENDAR

December — January — February

December 15—Sigma Tau initiation at 2:00 pm in Lisner Auditorium, followed by banquet and dance at 7:00 pm at Form Inn.

December 17—Christmas Tree lighting ceremony at 7:00 pm on Lisner Library terrace.

December 22—
to

Merry Christmas and Hoppy New Year.

January 2—

February 6—Winter Term Engineers' Mixer. Details to be announced. DON'T MISS IT!

February 23—Annual Engineers' Ball. Highlight of the engineers' social year. At the Washington Hotel at 10 pm. Music by the ALASKANS.

Theta Tau meets December 12, January 9 and 30 in D-202 at 8:15 pm
Sigma Tau meets December 19, January 16, and February 20 in Gov-201 at 8:15 pm.

Engineers' Council meets January 2 and 30 and February 27 in the Student Union Conference Room at 8:15 p.m.

Societies meet December 5 and February 13 in the Hall of Government at 8:15 p.m.

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... ON OUR COVER. A Buck Rogers view of corona effects in the High Tension Yard at the National Bureau of Standards.



EDITORIAL

SOME COMMENTS FOLLOW concerning the vast difference between theory and practice in the aims and conduct of the student professional societies. No gratuitous insults are intended to the leadership of these groups, some of whom are doing an unusually energetic job. The unfortunate thing is that some of these individuals are headed in what we believe to be the wrong direction. We hope to offer some constructive criticism.

In the first place, we think that the aim should be to give, not to get. Well-intentioned membership committees are urging those to join who cannot possibly attend meetings, because of classes or other personal reasons. The aim has been to get as large a nominal membership as possible, and to get added revenue. Persons who next year might be enthusiastic members are thus given an unfortunate first impression of the group. Our advice in this case is to accept as members only those who can participate fully.

We can see no reason save indolence for the failure of the societies to present a well mapped out program at the time memberships are solicited in the fall. Of course, not all the speakers could be listed, but field trips and other special events could, and at least the first meeting's schedule should be known.

Meetings should be conducted in a brisk and business-like manner. Here the chairman must do a little advance thinking and planning. The dreary, aimless meanderings of the usual society business meetings are enough to ossify the resolve and enthusiasm of even the most hardy. If necessary, get a stooge to throw a couple of unpopular but worthy motions on the floor and railroad them through. If this does not arouse at least angered participation from your members, they are dead indeed. The least the chairman can do is to have a definite agenda, and to get through it quickly and efficiently.

Offer your membership a real opportunity to develop their professional sense of public responsibility. The failure to do this is the most serious shortcoming possible.

Choose as subjects for most of your meetings topics of national or great local interest on which the professional man should have opinions. For example, the AIEE has not even discussed in the last four years the question of public versus private power, one of the most important questions facing the electrical industry today. Another example: a serious depletion of the nation's water supply faces us, and the ASCE hasn't mentioned the results of the survey conducted by the commission appointed by the President to study this dangerous situation. Stop talking about hyperbolically wound phase degenerators and discuss the critical shortage of trained manpower facing the country.

We believe that the societies can become live, progressive organizations by the expenditure of a little more effort directed along these lines.

Oil-Filled High Voltage Bushing

by William A. Wooldridge

Undergraduate in Electrical Engineering

The subject of high voltage bushings is likely to set those who are not directly connected with the art of designing, developing or applying them, agog with apathy. This article challenges this lack of enthusiasm in an important piece of electrical apparatus, as harmful to the best interests of the industry. It defines the purpose and gives the general description of modern, oil-filled high voltage bushings.

The purpose of the high voltage bushing is to provide a safe, economical path for high voltage current. High voltage bushings, rated 73 kv. and above, are applied, for the most part, on power transformers and oil circuit breakers. Contrary to popular opinion, bushings do not serve as insulators to this equipment but rather as conductors. Mechanically, one thinks of a bushing as something cylindrical in shape and employed to provide an appropriate passageway for a bolt or a shaft. Electrically, one may think of a bushing as something cylindrical in shape, employed to provide an appropriate passageway for high voltage current.

Good economy and general safety of personnel dictates the need for high voltage bushings to carry high voltage current in and out of power transformers and oil circuit breakers.

Oil filled bushings of the old design have been built for over thirty years. The long years of service which these bushings have given indicate without a doubt their positive worth to the industry. They do, however, have one main disadvantage: because they are open to the atmosphere, they require periodic inspections and maintenance to insure that they are functioning properly. This necessity for periodic maintenance motivated the development of the new design.

The new design is completely sealed from the harmful effects of atmospheric impurities. It has the following advantages over the old design:

1. Practically no maintenance because of the sealed construction.
2. Reduced diameter due to the elimination of porcelain clamping rings and the more efficient use of insulation.
3. Reduced weight.
4. Reduced oil content.
5. Lower dielectric losses due to its ability to retain its initial low power factor.
6. Relative simplicity of construction due to the use of center clamping and the elimination of flange clamping with its attendant bolting operations.
7. Elimination of corona-producing effects of voids in insulation by the use of oil permeable barriers.

The simplicity of assembly makes the erection of a modern oil-filled bushing worthy of mention. The center conductor (see Fig. 2) is threaded and soldered into the bottom washer. The

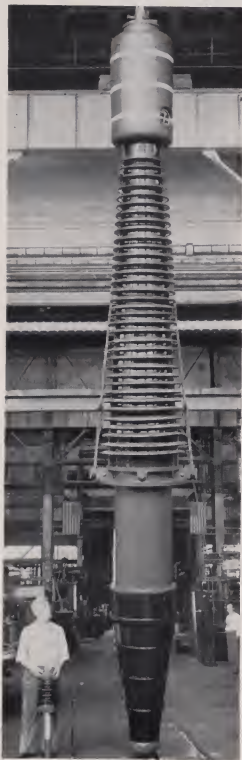


Figure 1.

bottom porcelain is placed over the center conductor until it rests on the bottom washer gasket. Each part in turn, including the insulated electrode support, concentric insulating cylinders, top porcelain shell and dome are assembled in a similar fashion. The spring assembly (see Fig. 2) is then placed in the top of the dome. The core seal gasket spring and washer are placed in the hub provided in the spring assembly. These two parts are shown immediately adjacent to the center conductor in Fig. 2. The threaded core seal gasket is placed in the cavity in the under side of the cover and it, and the cover, are screwed down on the center conductor until the springs are compressed sufficiently to give the correct compressive force on the gasketed joints between parts. Addition of the top terminal yields a completely assembled bushing, all parts being clamped together between the bottom washer and the cover of the bushing. This type of construction is called "center clamped". In the center clamped construction the center conductor is in tension at all times. The center conductors used in the new design are high strength, de-oxidized copper tubes with very low creep characteristics.

The insulated electrode consists of oil-permeable paper wound on an aluminum tube. The aluminum tube is electrically connected to the center conductor in the assembled bushing by means of a small spring. It serves to increase the effective diameter of the center conductor in an economical way and, thus, decrease the maximum voltage stress.

In manufacturing paper compound insulating cylinders it is difficult to prevent an occasional air-filled void in the structure. Such a void in a working bushing can result either in a disturbing radio noise characteristic due to corona formations or possibly in an internal failure. If the void, however, was to become filled with oil it would lose its power to lower the bushing efficiency. The ideal paper compound cylinder, then, is one which is oil permeable and which maintains sufficient mechanical strength after permeation. Such a compound has been found and is used in the insulating cylinders of the new bushings.

In the old design, metal rings cemented to the bottom and top of porcelain shells were used to bolt the porcelains to other parts of the bushing. This procedure produced tensile and shear stresses on the porcelain shells. Porcelain is weak in tension and shear but very strong in compression. The new design places the porcelain in strict compression.

The new bushing is a sealed structure, and under all conditions of normal service will maintain the proper level of bushing oil. Abnormal mechanical shocks and other mistreatment of a bushing could, however, cause leakage of oil. If excessive oil leakage should occur, the float-operated, magnetic, oil gauge provided in the dome of the bushing will indicate a

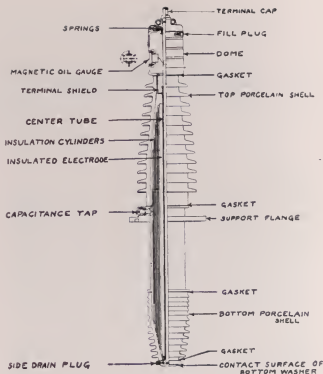


Figure 2.

low oil level and permit the bushing user to have the bushing repaired or rendered inoperative before any damage to the equipment can occur.

The new bushing employs an aluminum alloy casting for an expansion chamber. These castings are given special heat treatment which causes their tensile strength to approach that of steel but does not impair their machinability.

The support for the new bushing is of fabricated construction. It is fully as strong as the former casting and allows part of the machining to be done before the parts are welded together to form the supporting flange and ground sleeve.

All gaskets are of synthetic rubber which not only provides effectively sealed joints, but also gives a certain amount of desirable resiliency to completely assembled bushings.

Each bushing is put through a special treating and filling phase after assembly in order to remove all detrimental impurities from the insulation and bring the dielectric power factor down to a negligible value. The assembled bushing is placed in an oven at 110°C and a vacuum line fastened to the filling plug hole (see Fig. 2). The drain plug is then removed from the bottom end and a valve inserted in its place. Initially, this bottom valve is left open allowing the vacuum to draw hot air through the bushing. This process succeeds in heating up the inner insulation of the bushing enough to turn any

(continued on page 24)

What Will Happen to This Year's Graduate?

by **Emmett DeAvies**

Undergraduate in Electrical Engineering

FORTUNE magazine put it this way: there's "A Helluva Shortage of Engineers." It won't get any better — not before 1954, anyway. If American institutes continue to educate students under the present plan (and they will), this year's enrollment in the nation's colleges adequately describes the situation of the extreme shortage for at least the next four years. In ELECTRICAL ENGINEERING, Mr. Carley H. Brown, Chairman of the Engineering Manpower Commission said, "The multiplicity of advertisements for technical personnel wanted attests to the present need; figures of engineering enrollment in the colleges attest to the need of the near future." Before the Second World War approximately six per cent of the male high school graduates turned to engineering colleges. The rate, today, has dropped to lower than five per cent. But America needs at least ten per cent of these high school graduates in engineering during peacetime alone.

Last June, 38,000 graduates in engineering entered the professional world. The U.S. military and industry needed 95,000. Industry alone required 80,000 and yet half of last June's class will eventually be committed to the armed forces.

The first cold fact: At present this country is short 60,000 engineers. Industry is begging for men, professional men who are capable of the know-how and the know-why necessary in devising and improving the tools, methods, materials, and end commodities of mass production. But they just don't exist.

The U.S. military is taking the largest toll of trained engineers. Since 25 per cent of industry's technical staff is the reserve, recalls to military service have continually interrupted many development and research programs. Draft deferments left to the individual discretions of local boards have caused some thoughtless decisions to fill their quotas which placed students and graduates alike in the service. One Army camp survey revealed that the post had sixty engineers, largely non-coms and privates, who were spending half of their working hours in the household duties of the encampment; tasks which could be performed easily by others whose training was not equal to the technical background of the engineer. The bulk of the June graduating class who were drafted or recalled are occupied with non-engineering jobs.

The second cold fact: Despite the great need for manpower and know-how for defense mobilization, the U.S. military is not only draining industry of desperately needed men for civilian mobilization, but many technical talents are being wasted in irrelevant positions compared with their training. The armed forces still have time to devise some program that could utilize these engineers with maximum efficiency.

Since the beginning of World War II America has developed its industries far beyond the belief of anyone. Industrial research and development has increased some 500 per cent. The professional men entering these branches have only doubled in number. However, military programs of research have not only been highly successful in developing the implements of war, but they have also aided peacetime research with many methods and commodities developed for war, regardless of their inability to utilize all existing technical personnel in the military ranks.

The third cold fact: American civilian industrial development, because of lack of prime technical personnel, is not being allowed to expand normally. As a result, U.S. industry is fighting hard to obtain 30,000 engineers a year, the bare minimum to keep its staffs stable.

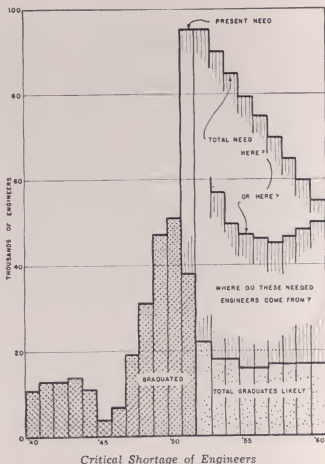
A little over 20,000 males entered colleges this year as freshman engineers. Some of them will obviously not finish for various reasons and therefore, at present, authorities are anticipating approximately 17,000 graduates in engineering in 1954 — a reduction of 21,000 from last year's class, 13,000 less than what private industry requires from normal turnover, and must have for coordinated operation. But before one concludes that industry will get the whole graduating class of '54, the fourth cold fact should be viewed: If draft and recall regulations continue, only 6,000 engineers of this year's freshman class, one-third of the new students, will be available for U.S. industry.

As reported in the employment story in last month's issue, the Bureau of Labor Statistics had published a report early in 1950 claiming that a surplus of engineers had begun to appear. The government agency claimed that employment of engineer graduates would be at an all-time low. Many nationally-known publications picked up the BLS release and consequently the Bureau's story became fairly widespread and un-

doubtedly fell into the hands of many high school boys who, otherwise, might have become engineers. Evidently, no one knew or expected the crisis that occurred in mid-1950. The Bureau, however, quickly recomputed its estimates of projection and released a new report. The report, which tries to overlook the first one, mildly says, "Boys interested in engineering, who have the aptitudes necessary for success in the field, should have favorable employment prospects when they graduate from engineering school." A repetition for emphasis: "Favorable employment prospects" is a term that the conservative report uses for the frenzy that began last fall, when nearly all available young men of a June graduating class had been snapped up, and employers continued to fill advertising columns with frantic pleas for engineers, almost any kind of engineers. *FORTUNE* magazine says about that period, "The U.S. by then was in the midst of a new social phenomenon and the most disturbing of all manpower crises." These two statements were the conclusion to statistics that the need for engineers is increasing at approximately 25,000 a year, still a conservative figure.

With a somewhat better idea of the overall rapidly deteriorating outlook for engineering manpower, the senior may view more clearly the situation that will confront him. He is a badly needed item in the defense of this country not only as an individual, but as a technical mind; he is a sorely needed commodity of industry's partially stymied development program; he is a widely sought-after product to cure some of the ills of basic research; and most of all, he is an essential figure in the nation's economy. And, therefore, the graduate engineer of next June will be worth more per pound than a prime cut of beef. The man with a bachelor's degree, in the next few years, will be more scarce than chromium or molybdenum or tungsten or a dozen other materials that are only base products of engineering.

Unlike many universities, many of George Washington's engineering students are already permanently employed and a larger per cent are older and unavailable for further military service under present regulations. Less of the graduating class will be placed in the armed forces; less will be interested in new job prospects. But for the rest of the School of Engineering members who will be leaving the University soon, most of them, like last year's class, will be employed many months before they take their final exams. Already, this year, the University Placement Office has asked engineers in the upper classes about their academic status and whether they are interested in seeking employment now. Already a schedule has been posted of the various company representatives who will come to the campus seeking these seniors; the bulletin board in the Student Union is continually filled with posters telling of the wonder-



ful opportunities to be had with Westinghouse, General Electric, York, Philco, aircraft corporations, instrument companies, and the like. This year's graduate, and even the next year's, will have little difficulty in obtaining a position which he feels meets his qualifications.

This year's graduate will probably have a chance at a minimum of three interviews. Last year's seniors in all colleges saw the big scramble. Talent scouts from some 4000 companies roamed through engineering colleges from the Atlantic to the Pacific, their brief cases overflowing with contracts, interviewing and exhorting prospects. Vice-presidents and sometimes even presidents of big companies went along giving talks and pleading for more men. Such companies as G. E. would dispatch three-man teams to go to universities, who would hold a pep-talk rally, rush into interviews sometimes offering the students \$290-\$375 a month for on-the-spot hiring. Some companies even offered all-expense trips to the main office to close the deals.

One company halted a portion of its research program while twenty-two of its own engineers conducted interviews. It got back twenty-one; the other had been hired by another team of interviewers. Biggest

(continued on page 20)

"ABEL" - A Digital Computer at the George Washington University

by Michael Rapport

Undergraduate in Electrical Engineering

Staughton Hall, formerly one of the girl's dormitories at the University, now houses the George Washington University Logistics Research Project. This project, under the general direction of Coordinator of Research Benjamin D. Van Evera, has for its use a general purpose digital computer. This computer, the Office of Naval Research Relay Computer nicknamed "Abel", is about 20 feet long, seven feet high, and two feet wide. It contains around 350 vacuum tubes and 700 relays.

A digital computer is a large-scale device which is adapted to problems requiring a large amount of time for their solutions. Its high speed in solving problems is obtained by the use of electrical circuits and relays which are almost instantaneous in their action. All of the fundamental arithmetic operations,

memory section by the control system, and used by the arithmetic section at the command of the control system to solve the problem. The solution appears either in typed form from an automatic typewriter, or punched into a paper tape.

Input information is read into "Abel" from a paper tape like this:



Fig. 2

This tape is run through the reader, which is an interpreting device that feeds the information from the tape into the memory section via the control system.

Numbers are stored in the computer in the memory section, which physically is the surface of a revolving metal cylinder $8\frac{1}{2}$ inches in diameter and 10 inches long. This surface is coated with a magnetic substance. The magnetic drum is constantly rotated past reading and recording heads placed .002 inches from the surface of the drum. A current flows in the heads at the proper instant, causing a small area of the drum surface to be magnetized. The location of these areas is controlled by the control system. The areas are grouped, and each group is called a "cell". It can be seen from the schematic

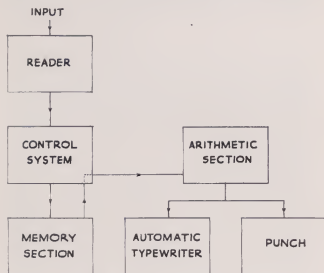


FIG. 1 - BLOCK DIAGRAM OF "ABEL"

i.e., addition, subtraction, multiplication, and division, can be accomplished by "Abel."

The computer is capable of performing any one of 39 different arithmetical, logical, or output commands at a given instant. Almost any type of problem capable of reduction to numerical solution by hand (integration, differentiation, differential equation solution, function evaluation, etc.) can be performed on "Abel."

The block diagram (Fig. 1), which has been reduced to the ultimate in simplicity, shows that input information is read by the reader, put into the

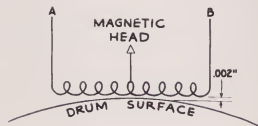


Fig. 3

diagram (Fig. 3) that current can flow from A to ground or from B to ground. The direction of flow of current, and therefore the direction of magnetization, is determined by whether it is A or B which is at a negative potential. This is determined by the presence or absence of a hole in the perforated tape run through the reader.

The decimal numbers have been coded in binary
(continued on page 22)

NEWS AND VIEWS

AIEE PLANS AMBITIOUS PROGRAM

A drop in enrollment and a decided shift to night school attendance, since many students are working full-time, is creating a serious handicap for the engineering societies at this university. In order to compensate for the loss of prospective members, AIEE has embarked on an impressive program for the coming semester for the purpose of attracting the greatest number of electrical engineering students currently enrolled at G.W.

The society has planned to hold, in addition to the regular meetings, at least one general meeting a month during the noon hour at which a topic intended to be of interest to all engineers will be presented by a well-known speaker. A field trip to Pepco's Alexandria thermal-plant is also on the calendar as well as a four- or five-day trip covering points of engineering interest on the Eastern seaboard.

The society got off to a good start by sending a delegation to the Second District Student-Counselors Conference October 19 and 20 at the University of Pennsylvania. The ten members, six officers and the branch counselor from GWU constituted the largest delegation to attend the conference representing 27 colleges, with the exception of the delegation from Penn. While attending the conference, delegates were given a side trip to Chester, Pennsylvania, for the purpose of inspecting the Ford assembly plant in that city. The group returned to the university and was conducted through Moore School, Pennsylvania's electrical engineering school. In the evening they were invited to a dinner at which AIEE President F. O. McMillan spoke on "Our Heritage from Engineering Education."

The first lunch hour meeting was held October 24th and the speaker was Mr. Henry Berring of the Weston Instrument Corp. Mr. Berring, the Educational Director for the company, spoke on "Three Fundamental Indicating Instruments," supporting his talk with demonstration and exhibition instruments. Mr. V. S. Madison of the Power Branch of the Economic Cooperation Administration spoke on "Foreign Electrical Systems and the Effect on Those Systems from U. S. Aid" at the noon meeting November 14.

The four- to five-day tour is scheduled for the week between semesters. The proposed itinerary includes Conowingo dam and hydroelectric plant, Westinghouse Electronics Laboratories at Baltimore, New York City power installations, Radio City, and the Okonite Cable Corp. plant at Passaic, New Jersey.

DEAN MASON SPEAKS TO GOTHAM ALUMNI

GW's New York Alumni, in order to maintain their association with the George Washington University and to keep up with its progress, invited Dean Mason to be their guest at a dinner last month. Dr. Mason spoke before this group, representing all the engineering professions, about "The Engineer and the World Today." In his speech he brought forth problems generated by the acute shortage of engineers. He also reviewed the engineer's part in the world as an individual: "It is toward an increasing awareness of their

possibilities, and more importantly, their responsibilities, that I believe engineers and engineering educators must direct their thinking." He continued to say that there has always been a traditional hostility among engineers toward a liberalization of their technical training such as adding courses in western civilization, elementary expositions of economics and readings in English literature to an already overloaded discipline in technical subjects. He feels that the only method is through teaching the student not only how, but why his knowledge will affect his fellow man and what this effect will be. As plans progress for the modernization and expansion of the Engineering School, Dr. Mason is attempting to make his fellow alumni aware of the growing need for better education for students in engineering, and the part the University must play in graduating men and women who are citizens as well as engineers.

RESERVE THE DATE OF THE ENGINEERS' BALL

The time is all too short before that gala occasion, one of the outstanding spring events in the University's social schedule, the Engineers' Ball, is upon us. Have you reserved the night of February 23 to take your favorite girl to this splendid affair? The dance will be held at the Washington Hotel Hall of Nations. REMEMBER THE 23d OF FEBRUARY.

CALDWELL RECEIVES ASCE AWARD

Dick Caldwell, CE, was presented with the student award of the District of Columbia Section of the American Society of Civil Engineers at the Society's annual meeting and dinner. The award, a certificate and check, is given each year to the outstanding civil engineering student at each of the District of Columbia's Universities, George Washington, Catholic, and Howard. The award is new and was presented for the first time this year.

The requirements for selection are that the student must have completed his junior year and shall have followed a civil engineering curriculum. He must be considered a prospectively successful engineer, and must have been of service to the student chapter and active in extra-curricular activities. His selection is further based on scholarship, character and personality.

Dick, well-known to most engineering students, expects to graduate in June. He is presently employed full-time by the District of Columbia Water Department and is a night school student. He actively participates in the Student Branch of the Society, is Regent of Theta Tau, Member of Sigma Tau, Engineers' Council, Mecheleciv Staff and Pi Delta Epsilon, national honorary journalism fraternity.

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WHEN TIN ISN'T TIN. This young man's baby food comes to him perfectly protected against contamination by airtight "tin" cans. But those tin cans are really *steel* cans . . . about 97% steel, with a very thin coating of tin. And U.S. Steel makes thousands of tons of tin plate every year to be used in forming billions of cans to safeguard food, oil, paint, and other items.



SIPHON WITH A STEEL THROAT. Extending around the north end of Soap Lake in the Grand Coulee area, this huge siphon, more than 22 feet in diameter, will carry irrigation water from an elevation of 1320 feet down into a 215-foot dip in the land's profile, and up again to an elevation of 1301 feet. The siphon is steel-lined concrete pipe. The 3400 tons of steel plate used to fabricate the liner sections were supplied by U.S. Steel, while the outside traveler and form (inset) and the inside traveler and collapsible ribs were especially fabricated by U.S. Steel for the casting of this large conduit.

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ALUMNEWS

Dave Wang, BME '51, has gone Southern. He is now down at Georgia Tech on a fellowship. Dave is instructing 15 hours a week in ME laboratory while he is working on his master's degree. Save your Confederate money, boys.

Jock O'Connor, BEE '51, has migrated with his family to Pittsburgh. He is employed by Blaw-Knox Corporation, a large engineering and manufacturing concern. We hear that Jock is expecting an addition to his family soon.

Dick Keister, BME, '51, has left Washington also. He has followed Jock O'Connor to Pennsylvania, locating in Media, Pa., with Westinghouse. He is in charge of weight control of Westinghouse's J-40 series turbojet engine. Dick tells us to watch the papers for flights of the F3H McDonnell "Demon", a Navy fighter plane, which has already made its first flight with his new J-40 engine. We apologize, Dick, for having listed you as an EE major in an earlier issue.

Another graduate who has made tracks to Pennsylvania (what has that place got?) is Jim Binckley, BME '51, who is employed by the York Corporation, York, Pa., as a sales engineer. Jim's new address is 760 Albemarle St., York, Pa.

John Fearnow, BME '51, writes that he is very pleased with his job. Unfortunately, John neglected to tell us what he was doing, but whatever it is, he's doing it in Winchester, Virginia.

We heard from Ken Leikari, BME '51, who writes from Akron, Ohio. He is employed by the Goodyear Tire and Rubber Company, and complimented us on the "Rubber Roads" story in our October issue. Ken's address is Box 203, E. A. S., Akron (5), Ohio.

There has been an addition to the family of Joe Rekas, BCE '51. Joe has named his son, born September 24. James Thomas Rekas. Joe is working as a highway engineer trainee with the Bureau of Public Roads in Arlington. Both he and Warren Frick, also BCE '51, and also a highway engineer trainee with the same organization, have been working on the Baltimore-Washington Parkway gaining experience, mostly in bridge construction.

Two alumni of the class of '29 gave our roving alumni correspondent a brief outline of their subsequent career. Both are now with the Bureau of Ordnance in the Navy Department. James A. S. Roy, BSEE '29 (with distinction) is now Principal Electrical Engineer and Electrical Consultant for the Bureau, where he has been since graduation. James F. Fox, BSME '29, after serving as a Mathematician in the Coast and Geodetic Survey and a Mechanical Engineer in the National Bureau of Standards, went to BuOrd in 1933, and is now Head Engineer of the Bomb Section, Research and Development Division. Neither of these gentlemen mentioned that each had received the Meritorious Civilian Service Award for outstanding work during the last war, but we found it out somewhere else.

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ENGINEERING PERSONALITIES

UNDERGRADUATE



Able Fred Battle, member of the Engineers' Council and past chairman of the George Washington University branch of the I. R. E., decided early in life that he wanted to be in the radio industry.

Fred was born 29 years ago in Bradenton, Florida. He says he "guesses that makes him a Florida Cracker, although he doesn't know exactly what the name implies. Before he had finished Bradenton High school in 1939, Fred had picked radio as his field, and wasted no time getting into it, beginning as a police radio dispatcher and technician at once after graduating. He worked a short while as a broadcast radio operator in Sarasota, but in 1941 a consuming curiosity about things electronic led him to Indiana Technical College, in Fort Wayne. He was doing fine there, until the recent small difference of opinion between Adolf, Benito, Hirohito and the rest of the world caused a temporary change in his plans.

Fred hankered for action, but couldn't see the Army, so into the Marines he went. Three guesses where the Marines put him. Wrong! For once ability and opportunity matched, and Fred served as a radio and radar technician until 1945, much of this time being spent in the Solomons Islands area. Battle saw "little enemy action to speak of" - he says.

By this time the three intransigents had been convinced of the error of their ways, so Fred and the Marines parted company, in Santa Ana, California. Radio called him immediately, and for the next year he was back at police dispatching and part-time broadcast operating at Santa Ana.

At Christmas, 1946, Uncle Sam again called Fred - but this time it was for a job in the CAA as maintenance technician for airport radar. He came to Washington to help install the radar at the National airport, and also helped with the radar at LaGuardia Field in New York.

While he was in Washington, Battle got acquainted with George Washington. He liked the place, and in the fall of 1947 he took leave and enrolled here to finish up his radio engineering course. He has worked with the CAA every summer since, and this year he transferred back to full time work in radar, taking part-time classes for his remaining 13 semester hours, which he expects to complete in June.

Fred has had a distinguished extra-curricular career while at GWU. He has been in the Radio Workshop (a dramatic group) since he came here, and a staunch supporter of IRE since 1948, serving as vice-chairman and then as chairman of the latter. He was also on the Mechelecev staff in 1950, a member of the Vet's Club, Theta Tau, and Sigma Tau. At present he is Sigma Tau's delegate to the Engineers' Council, a group which has long since learned to listen with attention to his proposals.

FACULTY



Professor Carl H. Walther was born in 1911, the son of a professional artist, some of whose paintings can be seen in the professor's office.

After graduating from high school, Walther went to John Hopkins University from which he graduated in 1931, "the worst possible time to graduate from college." He lasted exactly two weeks in his

first job. It turned out that he wasn't such a hot draftsman.

About registration time the next fall, nostalgia seized Walther, and he wandered down to John Hopkins to watch the boys register. There he saw the Dean. One idle question about a graduate scholarship, and he found himself enrolled. Two years later he emerged a Master of Civil Engineering, and forth he went into the world, working for a number of firms during the next few years, gathering experience.

1936 found Walther getting married (to one of his father's art students) and a structural designer with a consulting engineer, where he helped design the Armory and the Riding Hall at West Point. Walther's biggest job while with Col. Doleman, the consulting engineer, was working on the final assembly plant for Glenn L. Martin Co., a vast building with a 300-foot clear roof span. Doleman retired about this time, and Walther went to the Bethlehem Steel Company, in their Pottstown, Pa., plant where his first job was to figure the steel for the Martin building.

At Bethlehem, personnel problems forced much on-the-job training, and Walther spent much of his time teaching. The challenge of teaching appealed strongly to him, and he decided to make it his career. Inquiries convinced him that he would have to take a salary cut, but he had saved a little money, so he and his wife decided to try it.

Professor Walther chose GW because "the problem here interested" him, and he began as an instructor in 1939. In 1944 he was appointed assistant to the dean, then in 1946, assistant dean. He served as acting executive officer of the CE department and later as executive officer, from which office he resigned in 1949 because of his duties as assistant dean. He has been a full professor since 1949.

Professor Walther is a member of the local ASCE section, and was chairman of their committee for DC engineer registration legislation. He holds Professional Engineer certificates in both the DC and Maryland. He is faculty advisor to GW's ASCE chapter, a member of Sigma Tau, Omicron Delta Kappa, the American Society for Engineering Education, and the National Inventors' Council. He is also a committee member for the National Research Council and the Engineers' Council for Professional Development.

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● Theta Tau had a beautiful day and a lot of sunshine for its annual shrimp feast and football melee, open to the members of the professional societies for the first time this year. The weather and the promise of shrimp and beer brought out almost fifty members, alumni and friends. Some tried horseshoes, but the majority joined the football heroes who had some difficulty in deciding upon teams, but finally split up into the thin men versus the fat. The final score, as Al Moe (three guesses which side he played on) will tell you, was "Overfed 18, Underfed 6." The total tally for the afternoon was 70 pounds of shrimp eaten, one hour of football, fifteen cases of beer drunk, three hours of singing, and 50 happy people. The chapter met November 14 in D-202 after having the Cherry Tree picture taken, and made plans for another party early in December.

other party early in December.

Our alumni tell us they are planning a dance in the Airplane Room at the National Airport soon, so it looks like another successful season for Gamma Beta Chapter.



● Sigma Tau met November 21 in room 201 of Government building, and introduced at that time nine students who have been selected for membership. The new pledges are Robert J. Burns, Waldo R. German, Harry Kriemelmeyer, Daniel J. McCarthy, Alfred B. Moe, Richard B. Nearman, Leonard Plotkin, Charles H. Plyer, and Michael B. Rapport. At the same time, the Cherry Tree picture was taken. The chapter was advised that the plaque requested by Alpha Phi Omega for the Student Union Building had been completed and would be hung soon. It is a large replica of the key.

A barn dance was held on November 24 at the Jefferson Fire House in Arlington, starting Sigma Tau's social year off in a most successful manner.

Initiation of the new pledges is scheduled for December 15, and will be followed by the traditional Banquet and Dance.



● "Photogrammetry", the science of producing maps from stereoscopic pairs of aerial photographs, was the subject of a speech by Mr. R. E. Altenhofen, of the U. S. Geological Survey, at the meeting of the ASCE on November 7. Mr. Altenhofen told of the extensive work done here in this field since much of this type of equipment was captured from the Germans at the close of World War II, and discussed the basic principles of photogrammetry. He also showed some slides of captured equipment. A short business meeting was also held. The society plans a number of field trips for this year, but no definite dates have been set yet.

At our next meeting, to be held December 5, we are fortunate in having as our speaker Mr. Wesson Cook, planning engineer with the Prince Georges County Park and Planning Commission, who will speak on "City Planning."



● James Taylor Kemp told 28 ASME members, alumni and teachers about the Cornish Engine at the meeting held November 7. One of the most interesting speakers and topics the society has had for some time kept the group interested in the history of the steam engine's early days in England. Mr. Kemp showed a 45-minute movie of the huge engines in operation, and concluded his remarks with a description of the shutting down of one of them which had been operating for about a hundred years.

Bob Anderson and several of the members made the trip to Atlantic City for the annual ASME convention, November 25 through 29. All four full-time professors also attended, which meant no school for two days for the ME's.



German crowd, part of the 1,250,000 from East and West Berlin, sees a typical RCA television program.

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● Mr. Charles Ange, on loan to the National Production Authority from the Okonite Company, discussed cables and cable insulations at the AIEE meeting held November 7. He told us of one cable spanning the bottom of Puget Sound which was transported in a single length across

the country by a special flat-car arrangement. Refreshments followed Mr. Ange's interesting remarks.

On the 14th, eight members went over to the University of Maryland to see General Electric's "House of Magic" show featuring electrical phenomena, which is currently touring the East Coast.



● Almost forty members of the I.R.E. heard Ralph J. Stutz of the Bureau of Standards speak on "The Electronic Computer" at the first formal meeting of the IRE held November 7. Mr. Stutz described the interesting capabilities of different computers which have been or are

being developed in the United States, and showed slides of a number of computers.

We plan to have a number of field trips this year, the first of which is a tour of television stations scheduled for the near future. Details will be given at the next meeting on December 5, at which we will hear Dr. Harold Lyons, from the Bureau of Standards Microwave Group, discuss the absolute acme of timekeepers, "The Atomic Clock." There will be refreshments, of course.

THIS YEAR'S GRADUATE (continued from page 10)

scramble was for aircraft, chemical, electrical, automotive, oil, and mechanical equipment engineers in that order. Civil Service found itself running low too; there was no talk of written examinations and six-month waiting periods to fill the Government positions. Lockheed tried to hire the entire Georgia Tech junior class plus professors for the summer to get one of its plants in operation. One university said that even its worst students had gotten at least three offers.

Again, this year, our graduates will find themselves with a multitude of opportunities. Although, they will be choosy, they can well afford to be; they can also afford to decide not only what is best for themselves in opportunities, but also where they will be able to use their talents so that, in their own way, they will contribute their maximum effort to growth and development of the country.

"Effects of Defense Program on Employment Outlook in Engineering and Natural Sciences"—Occupational Outlook Handbook (Supplement N. 13)—Bureau of Labor Statistics, May 1951.

"Employment Outlook in Engineering"—Employment Outlook for Engineers (Supplement to Bulletin 965)—Bureau of Labor Statistics, August 1951.

"A Helluva Shortage of Engineers" by Lawrence P. Lessing—Fortune, Sept. 1951.

ELECTRICAL ENGINEERING, November 1951.



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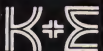
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Dragonfly eye for a war plane— blown of optical glass

As any naturalist can tell you, the dragonfly has one of the best eyes there is for seeing.

His eye is a button, set well out from his head. It lets the dragonfly see in all directions without craning his neck.

Now war-plane pilots aloft have just such a convenient eye to see with—the glass bubble shown above. Set in the skin of a plane—and fitted with an optical system—it gives a clear, horizon-sweeping view.

This new kind of eye for war planes marks the *first time* in the history of glass-making that perfect optical glass has been mass-produced by blowing. And because the blowing is so accurate, the bubble needs a minimum of grinding and polishing to meet exact optical specifications.

Before such a bubble could be blown, Corning had first to develop ways of forming optical glass shapes directly from the molten glass. This was accomplished during World War II, when Corning devised a method of manufacturing lens blanks of perfect optical glass by machinery.

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COMPUTER (continued from page 12)

form as combinations of ones and zeros as follows:

Decimal	Binary	Decimal	Binary
0	0	6	110
1	1	7	111
2	10	8	1000
3	11	9	1001
4	100	10	1010
5	101	etc.	etc.

A hole in the perforated tape represents the digit one, and the absence of a hole represents a zero. All numbers can thus be coded.

The control system consists of electronic counters, gating circuits, delay circuits, amplifier circuits, and relay clocks. The purpose of this section is to read the information from the drum at the proper instant and send it to the arithmetic section.

The arithmetic section is the heart of the machine. All computations are performed in this section by the use of relays, so wired that the fundamental arithmetic processes are performed automatically. Parts of this section interpret certain numbers as instructions to tell the section which operations to perform. The results of the computations performed in the arithmetic section are transmitted as electrical impulses to the automatic typewriter or the punch, whichever has been chosen by the

operator.

The art in the operation of the computer is the preparation of the input tape. The programmer must write out a series of commands which will solve the problems, using any of the 39 possible operations, in the proper sequence. The computer is then capable of performing them, or only some of them, or repeating them if necessary, depending on the results of calculations already done.

"Abel's" advantages lie chiefly in its speed (0.4 seconds per addition, 2.6 seconds for a multiplication or division involving seven-digit numbers, etc.), freedom from fatigue and human error, and its ability to perform the same set of computations repeatedly, using different data or initial conditions.

"Abel" is maintained by electrical engineering students at George Washington University under the supervision of Professor W. S. Carley. Four students, Charles Laughlin, Salvatore Servideo, Ken Parks, and Mike Rapport, work part time with Professor Carley on this project. Trouble-shooting technique is unique. Since there are literally several thousand paths through which the information flows, it is usually impossible to determine troubles by circuit tracing. By reading a series of control lights while a test routine is being run, one familiar with the basic 39 operations can often deduce logically the source of trouble.

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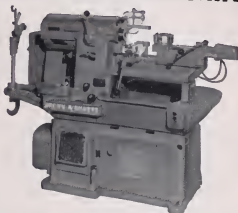
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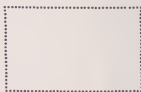
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OIL-FILLED BUSHINGS (continued from page 9)

moisture content to steam. This steam is drawn off through the vacuum line. The bottom valve is then closed and a vacuum drawn on the bushing. When a high degree of vacuum has been attained, the bushing is filled through the bottom with de-aerated oil while still under vacuum. The bushing is completely filled and the oil pressure left at 20 psi for an appropriate time in order to test all gasket joints for leakage. The bushing is then allowed to stand until the insulation has cooled to room temperature, whereupon the dielectric power factor is measured. If this power factor is too high, the bushing is drained, retreated, and refilled until a negligible power factor is obtained. The oil level of the bushing is then adjusted properly and the bushing sealed under 10 psi of nitrogen. This nitrogen cushion is provided in order to avoid the creation of a vacuum when the oil contracts.

Reference to Fig. 2 will show that in addition to oil, the new bushings employ concentric paper compound cylinders as part of their insulation. The space between any two of these concentric cylinders is called an oil duct. Wound into each of the concentric cylinders is a conducting element called an equalizer. A bushing without equalizers or with equalizers all the same length has high radial voltage stress near the center conductor and low stress out at the metal ground sleeve. In the new design the concentric equalizers are made progressively shorter as the cylinders into which they are wound increase in diameter. The bushing insulation is thus calculated to approach a number of equal capacitances connected in series. Since these capacitances approach equality, so do the voltages across each two equalizers. Equal voltage across each two equalizers coupled with standard oil duct thickness results in a close approach to equal radial voltage stress on the bushing oil at every point in the internal dielectric field.

The equalizers used in the new design are also placed in each insulating cylinder so as to produce a beneficial effect on the external voltage distribution, i.e., the various equipotential lines emanating from the inside of the bushing are kept far enough apart by proper equalizer positions to increase the value of voltage at which the bushing will arc or flashover externally. They are not, however, affected enough to cause the bushing to fail internally before it flashes over externally. On the contrary, the new bushing is guaranteed to flashover externally before internal damage occurs.

Bushing tests are divided into the several tests; a routine test which every bushing must pass, and the design tests, those which a pilot model must pass before the bushing is put into production. The routine tests include a high voltage, 60 cycle, one minute withstand and the 60 cycle minimum flashover tests. The new bushings, regardless if rating, must flash-

over externally without internal damage to the bushing. The design tests include positive and negative impulse, voltage flashover, and withstand tests and the sixty cycle wet flashover and ten second withstand.

Special tests also include certain mechanical tests such as a transverse force test which is too detailed for description in this article.

The new bushing has been produced in all ratings from 73 kv. to 345 kv. Each rating has successfully passed its routine and design tests.

The basic design proved its worthiness when it adapted itself quite readily to the 345 kv. bushings shown in Fig. 1. This bushing is over 26 feet long. It uses three tiers of springs in order to provide for conductor expansion and contraction; but otherwise is similar in detail to the smaller bushings.

A good high voltage bushing must provide a safe, economical path for high voltage current under all types of weather and temperature variations with a minimum of maintenance. The old breather-type oil-filled bushing performed satisfactorily for many years but required careful attention and maintenance. The modern hermetically-sealed oil-filled bushing has incorporated the good construction features of the old bushing with improved design possible through modern high quality materials.

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by H. V. FULLER, Supt. Time Study and Planning Dept.

General Machinery Division, ALLIS-CHALMERS MANUFACTURING COMPANY (Graduate Training Course 1939)



H. V. FULLER

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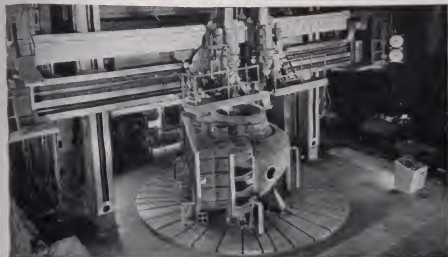
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